



PUTTING RESEARCH TO WORK

BRIEF

New Guidelines Take the Guesswork Out of Preparing Surfaces for Overlay

A significant portion of the asphalt pavement work in Wisconsin involves structural overlays of existing concrete or asphalt pavement. Typically, pavements that require overlays show surface or structural distress that should be repaired before overlay placement to prevent the existing weaknesses from hampering the effectiveness of the overlay.

What's the Problem?

Although Wisconsin DOT uses guidelines for overlay design, the department lacks standard directives for preparing the asphalt or concrete pavement surface prior to overlay. The field engineer working on the overlay must determine what type of preparation is necessary, and the lack of specific directives can put these engineers in difficult situations. For example, if significant surface preparation seems warranted, project time and costs may increase, or construction crews may be forced to insufficiently prepare the surface to meet cost projections. Overlays placed on insufficiently prepared surfaces may suffer shortened service lives.

With inconsistent surface preparation, overlay performance varies from project to project, making life cycle cost assessments and performance projections less reliable. Standardized surface preparation guidelines would provide more consistency in planning, design and construction.

Research Objectives

Researchers sought to develop design and construction guidelines for the surface preparation and rehabilitation of existing concrete and asphalt pavements prior to placement of an asphalt overlay. The guidelines should be able to be rapidly integrated into WisDOT's Facilities Development Manual and Construction and Materials Manual.

Methodology

Researchers reviewed state and national practices to identify the most effective methods of repairing existing pavements prior to overlay placement, then developed guidelines incorporating these best practices. Specifically, investigators:

- Reviewed current WisDOT procedures and national research.
- Evaluated the field performance of overlays currently in service in Wisconsin. Researchers reviewed pavement performance data from prior to and after overlay placement, noted the amount and type of pre-overlay preparation performed, and assessed the overlays' performance after several years of service.
- Evaluated three overlay projects from the 2004 construction season, assessing the condition of the pavements prior to overlay using distress surveys and falling weight deflectometer tests.
- Developed design and construction guidelines.

Results

Investigators developed guidelines for surface preparation prior to asphalt overlay placement, dividing the guidelines according to the material to be overlaid (asphalt or concrete). Key findings include:

Asphalt over concrete. Full-depth base patching using doweled concrete was the most effective method of repairing high-severity distresses in existing concrete pavements prior to overlay. When pavement needs to be opened to traffic in a short time, high-early-strength doweled concrete base patching may be used. In addition:

- For surfaces with medium-severity transverse cracks or longitudinally or transversely distressed

Investigator



"If you don't do enough surface preparation prior to placing an overlay, the performance suffers. You may only get 10 years of life, rather than 15 years. Our findings will help solve this problem."

—Haifang Wen

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“This research puts WisDOT on the road toward a consistent procedure for preparing distressed pavements for effective asphaltic overlays. This study will change the way we do things for the better.”

—Paulette Hanna

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Surface preparation prior to an asphalt overlay may include milling for asphalt pavement (at left; Fig. 4.7, page 48 of final report) and full-depth base patching for concrete (Fig. 4.18, page 56 of final report).

joints, partial-depth repair (typically using asphaltic patching or filling material) is effective.

- Overlay thickness should be a minimum of 3 inches, with 3.5 inches preferable, to mitigate reflective cracking into the overlay.
- High-severity transverse cracks and distressed joints should be repaired prior to overlay.

Asphalt over asphalt. For existing asphalt pavements with extensive alligator or transverse cracking, the pavement must be pulverized before overlay to prevent reflective cracking. For localized alligator cracking, removing and replacing the cracked areas is generally sufficient preparation. However, the base and subbase may also need to be repaired, and patching may be required. Other findings include:

- Pavements with block cracking (interconnected transverse and longitudinal cracks) and surfaces with minor rutting should be milled prior to overlay placement. (During milling, the surface layer is ground off to create an even surface for the overlay.) Major rutting indicates the need for base and subbase investigation.
- When pavements exhibit severe longitudinal cracking, the ratio of overlay thickness to milling depth should be at least 3:1; this will prevent longitudinal cracking from recurring in the overlay.

Benefits and Further Research

The guidelines produced in this study form the basis of a consistent overlay design and construction policy, which would improve predictability in project budgeting if adopted by WisDOT. This project will inform further research, which may include several topics:

- A detailed life cycle cost analysis of pre-overlay repair methods would refine engineers' ability to make decisions about how much surface preparation is necessary on a given project.
- Since concrete that has been previously overlaid may conceal severe damage beneath the existing overlay, research is needed to identify the pre-overlay repairs necessary for these pavements.
- Milling was not particularly effective in mitigating the impact of transverse cracking in existing asphalt pavement on overlays. Effective repair of transverse cracking prior to overlay should be studied further.
- To reduce asphalt pavement's susceptibility to thermal cracking, a study of WisDOT's current asphalt mix designs and binders is needed.
- Adjusting some weight factors for distress recording in WisDOT's Pavement Information File database will increase the PIF's value as a pavement performance database and distress calculator.

This brief summarizes Project 0092-04-05, “Guidelines for the Surface Preparation/Rehabilitation of Existing Concrete and Asphaltic Pavements Prior to an Asphaltic Concrete Overlay,” produced through the Wisconsin Highway Research Program for the Wisconsin Department of Transportation Research, Development & Technology Transfer Program, 4802 Sheboygan Ave., Madison, WI 53707.

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